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May 28, 2016

Federal Communications Commission
C/O Mr. Gregory Cooke
Associate Chief
Policy, Licensing and Safety Division
Public Safety and Homeland Security Bureau
445 12th St., S.W.
Room TW-A325
Washington, DC 20554

Re: ***<u>P.S. Docket No. 16-32, Earthquake-Related Emergency Alerts</u>***

Dear Mr. Cooke:

This filing follows upon our Notice of Ex Parte Communications that Seismic Warning Systems ("SWS") filed with the Federal Communications Commission as part of the record for *P.S. Docket No. 16-32, Earthquake-Related Emergency Alerts*. A copy of our original filing is attached.

Background

SWS has significant concerns regarding how earthquake-related emergency alerts are being addressed by disparate Federal stakeholders. In particular, we believe that the earthquake warning ("EQW") system contemplated by U.S. Geological Survey ("USGS") is riddled with functional weaknesses Specifically:

1. *System Architecture*. The basic system architecture being used by USGS leverages the Advanced National Seismic System. ANSS was developed for research purposes rather than EQW. As a result, the proposed architecture for the USGS EQW product known as "Shake Alert" has a number of technical limitations that slow EQW alerts, create blind zones near seismic epicenters, and pose performance issues related to false positives and undistributed alert messages.

2. *Signal Delivery*. The operational strategy that USGS appears to be following has significant weaknesses in terms of end-user needs and applications. Our understanding is that USGS intends for EQW warnings to be delivered primarily by third party providers. USGS has yet to articulate how such a system will address liability for missed alerts and false positives.

3. *IPAWS/WEA Integration*. USGS has stated publicly that it intends to disseminate EQW alerts via the Integrated Public Alert and Warning System ("IPAWS") and the Wireless Emergency Alert ("WEA") System. There is significant confusion as to how integration between EQW messages generated by the ShakeAlert decision module would work within the IPAWS alert generation infrastructure. In light of the stakeholders in IPAWS, its strengths and limitations, it is unclear whether the USGS approach makes sense at this time. As for WEA, the current telecommunications infrastructure is not presently capable of handling the volume of traffic that an EQW alert would generate. By its own admission, USGS states publicly that we are at least five to seven years away from having the infrastructure capable of handling an EQW alert via WEA.

The result of these weaknesses portends a system that erodes public trust in IPAWS alerts in general and EQW warnings in particular.

At this time, we believe that pre-mature widespread public alert and warning for earthquakes will erode the public's perception of earthquake warning and not have the positive outcomes desired. Automated earthquake detection, analysis and near instantaneous delivery of the warning should be a requirement. In contrast, Seismic Warning Systems, Inc. has deployed a commercial system designed to provide reliable and actionable EQW alerts. Our technology (known as QuakeGuard™) has been in commercial use for the past fifteen years and has a flawless performance record. Because we have direct experience in providing earthquake warning, we believe that we are well qualified to make these statements and recommendations.

SWS Response to P.S. 16-32, Earthquake-Related Emergency Alerts

On April 9, 2016, the Federal Communications Commission (hereinafter, "FCC" or "the Commission") issued a Public Notice concerning Earthquake-Related Emergency Alerts (P.S. Docket 16-32), in which the Commission requested specific comments on the status of EQW. Seismic Warning Systems, Inc. respectfully submits the following comments:

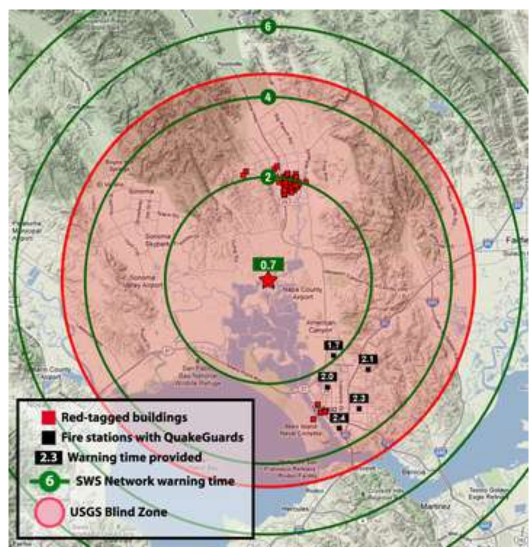
"[W]e seek comment on technical aspects of IPAWS and its associated alerting systems, as well as other alerting schemes with which the Commission has not previously been involved, in order to build a robust record on potential models for delivering earthquake early warning (EEW) to the entire public in fewer than three seconds."

In order to develop and deploy an EQW system that instills public confidence, SWS believes the following issues must be clarified:

1. *Latency.* As a general matter, we view latency as the time it takes from the commencement of a seismic event to the final delivery of the alert to the intendent recipient or client action.[1] The existing USGS ShakeAlert architecture has significant latency issues, as it requires a minimum correlation of four sensors. Additional latency may be caused by error factors and other performance issues with the ShakeAlert decision module. ShakeAlert latency is further increased by its manual alert generation process and its aggregation and dissemination activities. Recent beta tests of ShakeAlert indicate that these activities add a full six seconds of latency to the system, not counting any additional delays attributable to its strategy of dissemination using third-party commercial providers. Taken together, the current performance metrics for ShakeAlert offer sub-optimal performance.

2. *False Alerts.* USGS acknowledges a false alert rate of 5%-10%, as well as an "acceptable" rate of missed alerts/events. Aside from the direct and negative impact on the public confidence in EQW, the FCC and Congress need to consider the deleterious effect on other emergency alert notifications and the IPAWS/WEA system as a whole. It should be noted that unlike the proposed performance parameters of USGS's ShakeAlert, SWS's QuakeGuard™ has a perfect record of never initiating a false positive nor missing a warning in its fifteen years of commercial deployment.

3. *Blind Zones.* Because of technological limitations, the proposed ShakeAlert system will not be capable of providing any meaningful alerts whatsoever in areas within a ten-mile radius of the epicenter. Those within the 315 square miles of these so-called "blind zones" will be the most impacted by significant seismic events. Thus, the current iteration of ShakeAlert will not be able to provide warning to those in the greatest danger. In contrast, SWS's QuakeGuard™ has been engineered to eliminate blind zones and provide coverage for those immediately affected.[2]



4. IPAWS exacerbate blind zones?
    a. The request from Congress to evaluate whether or not IPAWS/WEA can be improved to meet a 3 second latency target

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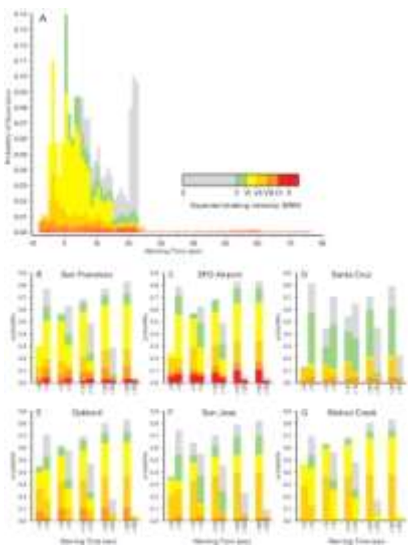
[1] We also submit with response an open paper prepared by subject matter experts on EQW standards of performance. Section 4.7 specifically addresses latency, section 4.9 speaks to acceptable levels of reliability for warning release, and section 5.1 talks about typical performance warning times. We hope our analyses are helpful and contributory.

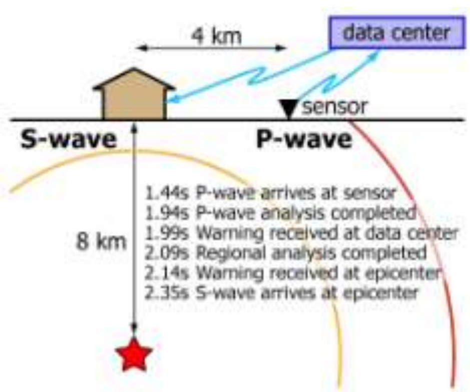
[2] In general terms, EQW times must account for the fact that P-wave detection at the monitoring site is possible. The approaches to earthquake detection, analysis and warning distribution produce very different results. These results can manifest as "Blind Zones" around the epicenter of an earthquake. Blind Zones are exacerbated by additional latencies in the delivery mechanisms. We have attached an example from the Napa Earthquake. This event clearly demonstrated the performance difference between the private sector approach and that of ShakeAlert.

PARTIALLY misses the point. Long EEW warning times have been promoted, but these are only for places far from large earthquakes; These earthquakes are rare.



b. For the purpose of IPAWS / EQW evaluation and benefits, its critically important to set the communications 'baseline performance matrix' on the far more common (10 times on average) local moderate earthquakes.[3] Since these are close by, the shaking intensity is nearly the same as for large and remote. Those near the epicenter deserve protection. A 3 second communications latency must be added to the EEW latency, which, for most EEW systems, is also at least 3-6seconds. The S-wave travels 21km in 6 seconds. That's an area of 1,400 square kilometers. If the EEW system takes zero time, the stated goal for WEA still leaves nearly 400 square km unprotected. If you evaluate all likely moderate and larger earthquakes that any location will experience, the average warning time is about 15 seconds.

c. The SWS goal is 0.75 seconds, which beats the S-wave for all likely earthquakes. If a new system is to be designed, it should at least equal the performance of current technology.



5. *Utility.* At present, the USGS system provides a simple alert of imminent seismic activity. It does not differentiate between those who may face immediate threat of harm versus those who are outside the danger zone. This approach will undermine the effectiveness of earthquake warning alerts in general, as individuals who receive all warnings will become

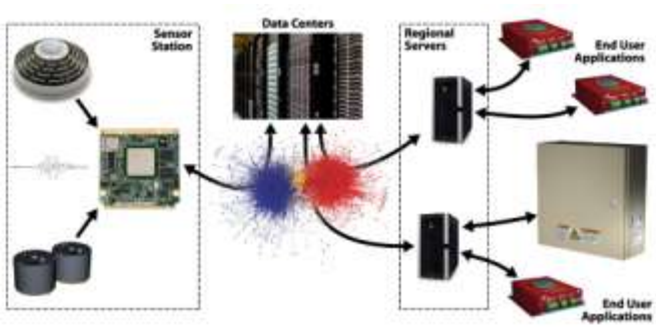
[3] file:///C:/Users/snebenzahl1/Documents/2016%20FCC/AllenSRL2006.pdf

desensitized to the alert protocols. Thus, when such persons are actually in the danger zone and alerted, they may not take immediate action.

Another issue regarding utility focuses on what actions should be taken in the event of an alert. For individuals, it will obviously mean taking cover. For commercial activities, however, a key functionality must be the linkage of the EQW signal to industrial controls in order to mitigate life/safety and economic harms. Examples of such integration might include raising equipment doors for emergency management vehicles, automatic braking of high speed railroads, or automatic parking of elevators on the ground floor. As currently envisioned, the ShakeAlert system will not provide integration for industrial controls; the USGS ShakeAlert signal will merely be a warning of imminent seismic activity.

"We seek information regarding how differences in alerting infrastructure and delivery methodologies affect incremental and overall system latencies and delays. To properly define the scope of our inquiry, we seek comment on the extent to which our analysis of the feasibility of delivering earthquake early warnings requires an analysis of each step in the alert generation and dissemination process for each type of alert (e.g., WEA and EAS), in order to identify and, to the extent feasible, reduce or eliminate any delays or latencies. We also seek information concerning whether, in addition to signals and cell phone protocols, there are additional parameters associated with the dissemination of alerts, such as factors associated with broadcast and Internet messaging, that the report should include in its analysis…[W]e seek comment on the appropriate points in the IPAWS alert dissemination process from which we should measure latency. Would it be appropriate to measure latency from the moment the alert is received by the IPAWS A-interface to the moment it is delivered to an end user?

1. *Latency Measurement.* As a starting point, latency must be measured from the point of earthquake detection to final delivery to the intendent recipient or client action. Any other measurement undermines the value of the warning to end users.



Latency timeline commences from the detection at a single sensor station thru to the delivery of services to the end-user. The time budget for a successful EQW must meet or exceed 0.75sec. inclusive of communications distribution components. (IPAWS/WEA or Other)

2. *Nature of the Alert.* We have concerns about using the IPAWS/WEA systems as the sole mechanism for EQW alerts. Both raise additional latency issues (and for WEA, questions surrounding telecommunications infrastructure capabilities). In addition, because EQW warnings have a limited event horizon, subject matter experts have noted that earthquake warnings require a different approach than other emergency alerts. A number of federally-sponsored studies on alerts and warnings completed by Dr. Dennis Mileti, Ph.D. and others

in the field raise important question about the effectiveness and ability to produce meaningful human reaction to EQW within the current limited scope and technical outputs available via IPAWS/WEA. In particular, there is definitive research regarding the content, order, and delivery of warnings. Seismic Warning Systems has optimized its warning protocols to account for human nature and technological capability. It is clear that ShakeAlertas envisioned, has not.

3. *Statutory Authorities and Stakeholder Structure*. While the Commission has requested technical comments on the IPAWS feasibility for EQW, one question remains unresolved: which executive branch agency has primary authority in this area. USGS asserts a Stanford Act mandate; however, the question has not been actually resolved. A related issue is the interplay between USGS and FEMA. We understand that USGS is negotiating with FEMA to be granted status as an alert originator. We question whether USGS is sufficiently staffed and has operational experience for such responsibility. Unlike NOAA and NWS; USGS does not have either sufficient personnel or experience to undertake such a critical role in the issuance of public warnings.

   Further, USGS relies on its Regional Seismic System operators (mainly public and private academic institutions). This is a tenuous structure, and raises many questions regarding authorities, liability, accountability, etc. For example, the USGS West Coast Implementation Plan relies on the California Integrated Seismic Network ("CISN"); however, there are two separate operations centers that comprise CISN. Similarly, the ShakeAlert system architecture has a decision model that resides in various servers operated by subcontractors. Does USGS intend to confer its alert originator status on these organizations? Is this a legal and proper delegation of authority? The fragmented system USGS proposes raises serious questions regarding legality, interoperability and reliability.

[W]e seek comment on the relative benefits and weaknesses of beginning to measure EEW delivery time from that point. In addition, we seek comment on the effect that each particular starting point would have on the technical feasibility of delivering EEWs to the public in fewer than three seconds.

As a member of the California Earthquake Early Warning Working Group, Seismic Warning Systems has submitted a number of papers and analyses regarding EQW. It is clear from both current ShakeAlert performance and from IPAWS architecture providing meaningful EQW within a three second window is not feasible with today's technology. That is not to say, however, that EQW outside of that performance envelope is meaningless. A properly deployed EQW system can provide sufficient warning for a sizeable percentage of those in danger to mitigate risk. Obviously, the greater the warning time, the more mitigation that can occur. We note that when compared to its commercial counterparts such as SWS's QuakeGuard™, the performance of USGS's ShakeAlert provides less warning time to fewer parties with higher degrees of false positives and missed alerts.

Conclusion

Recently, a number of articles have been written by the press, questioning why EQW technology has been so slow to be deployed. Earthquake warning is an emerging technology and by its very nature, requires a different set of operating and performance expectations as compared to other types of warnings that are issued to the public. We hope to share our knowledge by reaching out to various stakeholders (including the leadership at USGS) and pursuing a more collaborative approach to EQW – one that leverages the cutting-edge research of USGS scientists, agency expertise in areas of emergency management and telecommunications, and the efficiencies and agility of the private sector.

Over the past fifteen years, Seismic Warning Systems has had its technology in place, mitigating seismic hazards for our commercial clients. Our QuakeGuard™system an enviable track record – one that meets or exceeds ShakeAlert's performance (as envisioned by USGS) in every performance category. We look forward to deploying our second generation technology, which will increase warning times and coverage areas further for commercial clients as well as the public at large.

Widespread use of EQW technology requires a thoughtful approach as to how the warnings should be conveyed to protect as many Americans as possible. In that context, the Federal Communications Commission is doing a great service by raising these questions and seeking a pathway to full implementation of earthquake warning technology.

We appreciate the opportunity to augment our earlier correspondence and discussions, and look forward to working with you in the future.

Sincerely,

Scott Nebenzahl
Vice President and Director of Government Affairs